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FEB 12 2007

In re Patent Application of
PAU ET AL.
Serial No. **09/390,554**
Filed: **SEPTEMBER 3, 1999**

In the Claims:

This listing of claims replaces all prior versions and listing of claims in the application.

Claims 1-4 (Canceled).

5. (Currently amended) A method of calculating [[the]] a discrete cosine transform (DCT) of blocks of pixels of an image for compressing image data to be stored or transmitted, comprising:

a) defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i * N/2^i$, where i is an integer;

b) defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

c) ordering the pixels in the range blocks of a certain dimension by rearranging input pixels in 2^i vectors of 2^i components;

d) calculating, in parallel, 2^i monodimensional DCTs by processing the vectors defined in [[the]] step c);

e) arranging output sequences of the monodimensional DCTs relative to the 2^i vectors;

f) completing the calculation in parallel of 2^i bidimensional DCTs by processing output sequences of monodimensional DCTs produced in step e); and

g) arranging output sequences of bidimensional DCTs generated in step f) in 2^i vectors of bidimensional DCT coefficients.

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6. (Canceled)

7. (Currently amended) [[A]] The method according to Claim 5, wherein the step of calculating 2^i monodimensional DCTs in parallel in step d) and the step of completing the parallel calculation of 2^i bidimensional DCTs of step f) are performed by subdividing the sequences resulting from step c) and from step e), respectively, in groups of scalar elements, calculating the sums and differences thereof by way of adders and subtractors and by reiterately multiplying the sum and difference results by respective coefficients until completing the calculation of the relative DCT coefficients, respectively monodimensional and bidimensional.

8. (Currently amended) A method of compressing data of an image to be stored or transmitted, comprising ~~the steps of~~:

defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i * N/2^i$, where i is an integer;

defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

calculating, in parallel, the DCT of 2^i range blocks of a relative domain block;

classifying the transformed range blocks according to their relative complexity represented by a sum of values of three AC coefficients;

applying a fractal transform in the DCT domain to data of the range blocks whose complexity classification exceeds a pre-defined threshold and only storing a DC coefficient of the range blocks with a complexity lower than the threshold, while identifying a relative domain block to which the range block in a transformation belongs that produces a best fractal approximation of the range block;

calculating a difference between each range block and its fractal approximation;

quantizing the difference in the DCT domain by using a quantization table preestablished in consideration of human sight characteristics;

coding the quantized difference by a process based on probabilities of quantization coefficients; and

storing or transmitting code of each range block compressed in the DCT domain and the DC coefficient of each uncompressed range block.

9. (Currently amended) An apparatus for calculating [[the]] a discrete cosine transform (DCT) of blocks of pixels of an image for compressing image data to be stored or transmitted, the apparatus comprising:

means for defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer;

means for defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

means for ordering the pixels in the range blocks of a certain dimension by rearranging input pixels in 2^i vectors of 2^i components;

means for calculating, in parallel, 2^i monodimensional DCTs by processing the vectors defined by the means for calculating;

means for arranging output sequences of the monodimensional DCTs relative to the 2^i vectors;

means for completing the calculation in parallel of 2^i bidimensional DCTs by processing output sequences of monodimensional DCTs produced by the means for arranging output sequences of the monodimensional DCTs; and

means for arranging output sequences of bidimensional DCTs, generated by the means for completing the calculation, in 2^i vectors of bidimensional DCT coefficients.

10. (Canceled)

11. (Currently amended) The [[An]] apparatus according to Claim 9, wherein the means for calculating 2^i monodimensional DCTs in parallel [[in]] and the means for completing the parallel calculation of 2^i bidimensional DCTs are for subdividing the sequences resulting from the means for ordering and the means for arranging output sequences of the monodimensional DCTs, respectively, in groups of scalar elements, calculating the sums and differences thereof by way of adders and subtractors and by reiterately multiplying the sum and difference results by respective coefficients until

completing the calculation of the relative DCT coefficients, respectively monodimensional and bidimensional.

12. (Previously presented) An apparatus for compressing data of an image to be stored or transmitted, comprising:

means for defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer;

means for defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

means for calculating, in parallel, the DCT of 2^i range blocks and of a relative domain block;

means for classifying the transformed range blocks according to their relative complexity represented by a sum of values of three AC coefficients;

means for applying a fractal transform in the DCT domain to data of the range blocks whose complexity classification exceeds a pre-defined threshold and only storing a DC coefficient of the range blocks with a complexity lower than the threshold, while identifying a relative domain block to which the range block in a transformation belongs that produces a best fractal approximation of the range block;

means for calculating a difference between each range block and its fractal approximation;

means for quantizing the difference in the DCT domain by using a quantization table preestablished in consideration of human sight characteristics;

means for coding the quantized difference by a process based on probabilities of quantization coefficients; and

means for storing or transmitting code of each range block compressed in the DCT domain and the DC coefficient of each uncompressed range block.

13. (Previously presented) An apparatus for calculating the discrete cosine transform (DCT) of blocks of pixels of an image for compressing image data to be stored or transmitted, the apparatus comprising:

a first defining unit to define first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i * N/2^i$, where i is an integer;

a second defining unit to define second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

an ordering module to order the pixels in the range blocks of a certain dimension by rearranging input pixels in 2^i vectors of 2^i components;

a first calculating module to calculate, in parallel, 2^i monodimensional DCTs by processing vectors defined by the calculation unit;

a first output module to arrange output sequences of the monodimensional DCTs relative to the 2^i vectors;

a second calculating module to complete the calculation in parallel of 2^i bidimensional DCTs by processing

output sequences of monodimensional DCTs produced by the output module; and

a second output module to arrange output sequences of bidimensional DCTs, generated by the second calculating module, in 2^i vectors of bidimensional DCT coefficients.

14. (Canceled)

15. (Currently amended) The [[An]] apparatus according to Claim 13 ~~for calculating the discrete cosine transform (DCT) of blocks of pixels of an image for compressing image data to be stored or transmitted, the apparatus~~ further comprising :

~~a first defining unit to define first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer;~~

~~a second defining unit to define second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels; and~~

an array of adders, subtractors and multipliers and a plurality of path selectors and multiplexers for configuring the array according to a selected value of said integer i, for calculating the DCT on either the undivided domain block of $N*N$ pixels or, in parallel, on said range blocks of subdivisions of the domain block.